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NOTE ON A TOUR

IN

JODHPUR STATE

BY

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April 1944.

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Note on a tour
in Jodhpur
1944.

COMPLIMENTARY

Table of Contents.

Summary	Before para 1.
General	...	...	...	...	...	Paras. 1—4.
Forest Policy and Management	...	...	...	...	...	" 5—10.
Private ownership	...	...	...	...	...	" 11—14.
The Tract	...	...	...	...	...	" 15—30.
Analysis of the land management	...	...	...	...	...	" 31—36.
Recommendations	...	...	...	...	...	" 37—52.
Finance	...	...	...	...	...	" 53—57.

Summary

		para.
Itinerary	...	1—2
Acknowledgments	...	3
Only some 5,545 square miles out of 36,000 square miles is <i>khalsa</i> land.	...	4
There appears to be no written Forest Policy but there is a Marwar Forest Act of 1934.	...	5—6
The 320 square miles of reserved forest is partly under proper working plan under coppice system on a 40 year rotation. The plan ends in 1946 and needs revision. I recommend the coppice with standard system.	...	7—8
Right holders do unnecessary damage as permits allow felling at any time and at any place. I suggest limiting rights fellings to one or two months in the year and to a definite coupe about to be felled.	...	9
Guzara forests set aside for village rights in 1906 have largely disappeared from excessive felling and grazing.	...	10
Forests fulfil an important protective function against floods and erosion. They are not a mere local possession and bad forest management in the Himalayas can effect the people of Bengal. Correct management of the <i>khalsa</i> area of the Jodhpur State is of little use unless the 31,000 square miles of <i>jagir</i> are also properly managed.	...	11—12
Private ownership of forests has had to be regulated in all European countries and has broken down in the United States and in British India. A Private Forest Act appears necessary in Jodhpur.	...	13
The private lands are more denuded than the <i>khalsa</i> area.	...	14
The Aravalli hills form the eastern boundary of the State running roughly in a south western direction from near Ajmer-Merwara to Mt. Abu. These hills are the headwaters of the main river system, the Luni river. The rest of the country is generally flat though sometimes undulating with odd masses of hills. Except for the reserved forests the hills are either bare or covered with scattered stunted trees browsed down to the ground. The soil is generally fertile wherever there is moisture.	...	15—18
The rainfall decreases from east to west, being about 20 to 25 inches on the Aravalli ridge, under 14 inches at Jodhpur city and probably down to 8 inches in the extreme west.	...	19

Certainly down to 12 inches this rainfall is sufficient to support tree growth. Trees can even survive down to 8 inches of rainfall.

Surface evaporation at Jodhpur is $7\frac{1}{2}$ ft. per year and over $2\frac{1}{2}$ ft. in April, May and June. There must be tremendous desiccation from the surface soil. Anything which could prevent this would help the general fertility of the country.

Wind erosion is very great. In some places 25,000 tons per square mile each year has disappeared for at least 50 to 100 years. In places six crore of maunds of surface soil per square mile has disappeared. Anything which could prevent this would be of great value to the State.

From Jodhpur towards Ajmer the country is flatish and on the whole very dry with scattered tress of *Prosopis spicigera*. For 10 miles round Pali and towards Marwar junction every tree has been removed and over large areas the country is reduced to almost desert conditions with serious wind erosion. However, from Pali towards Sirohi conditions improve and there is a large amount of *Cassia auriculata*, *Salvadora oleoides*, *Acacia leucophloea* and *Prosopis spicigera*. Almost every where numbers of trees are browsed down to the ground. Closure to grazing and especially closure to the goat would allow the forest to spring up in a few years.

The closure of the hills 80 miles south of Jodhpur city near Sanderao would bring up a forest of *Anogeissus pendula*.

Going west from Jodhpur to Sheo the country gets progressively drier, the first sand dunes appearing about 50 miles out. Over all this area, however, though the rainfall probably goes down to 10 inches, fairly well grown specimens of *Prosopis spicigera* show that trees could grow. By 100 miles westward trees disappear and only *Capparis aphylla* and *Zizyphus jujuba* remain though the soil is still good. I saw no shifting sand dunes, all being covered with vegetation.

South of this east-west line towards Balotra there is more moisture and better trees of *Prosopis spicigera*, *Acacia arabica* and *Anogeissus coronata* etc.

The plant *Prosopis juliflora* has spread naturally for $3\frac{1}{2}$ miles from Balotra and up to $1\frac{1}{2}$ miles has formed a dense forest. Some trees are already 3 inches in diameter and 20 ft. high.

The rainfall is only about 12 inches. This tree can solve the forest problem for a large part of dry India, at any rate down to a rainfall of 12 inches.	...	
Out of the 5,545 square miles of <i>khalsa</i> area, only 320 square miles is under the Forest department. The figure for cattle population is probably too low but is said to be 320,000 cows and buffaloes. There are also 7 lakhs of sheep and over 3½ lakhs of goats besides horses, mules and camels in the same area.	...	31
The forest area is only 6 per cent of the total <i>khalsa</i> area and for the whole State is only just over 1 per cent. It probably ought to be 20 or 25 per cent.	...	32
Such a small amount of forest must mean lack of timber and fuel with the consequent burning of cowdung. The cows and buffaloes in the <i>khalsa</i> area produce 5½ lakhs of tons of manure per year which should adequately manure 230 square miles of land or say 14 per cent of the whole of 1648 square miles of cultivation in the <i>khalsa</i> area. Probably at least half of this cowdung is burnt so that the burnt cowdung could adequately manure 7 per cent of the total cultivated area. Whether the figures are correct, they are sufficiently correct to show the importance of using this cheap source of manure to improve food production rather than burning it.	...	33
Assuming the ideal forest area of the <i>khalsa</i> area should be between 1100 and 1400 square miles, it means finding between 800 and 1100 square miles more. This should easily be possible out of the 3,500 square miles of current fallow, culturable waste and unculturable waste. This area could then be so distributed that it would supply the villagers' needs for small timber and fuel.	...	34
The over-grazed waste lands probably produce not more than 3 to 4 maunds of dry hay per acre per annum. Some very simple grazing regulation could very easily treble this output.	...	35
With an adequate area under forest to supply the villagers' needs and save cowdung for manure and with regulated grazing the general prosperity of the State and the people would improve vastly. Food and fodder production would increase and with the fodder from the pods of <i>Prosopis juliflora</i> , if that species were used for afforestation, fodder famines would cease. The general fertility of the country would improve and the force of the desiccating hot weather wind would be mitigated.	...	36

Recommendations.

	Para
The objects of policy and management appear to be—	... 37
(a) Protective on climatic and physical grounds.	
(b) To produce timber and fuel and save cowdung.	
(c) To preserve cattle.	
(d) Shikar etc.	
A forest policy should be written and a Private Forest Act ...	38—39
should be drafted.	
The land should be classified and a proportion dedicated for ...	40
trees especially on hilly areas.	
All hilly areas should be under the Forest department. ...	41
Outside the hills the agency of management must be decided ...	42
but the Forest department should direct. The object of management should be to produce small timber and fuel, the rotation being 15 to 20 years. The first return will come within 5 years.	
Over large areas protection and regulation of grazing alone ...	43
would produce a forest in a very few years.	
This is well known to His Highness who has closed areas near Jodhpur and near Sardar Samand with surprising results. ...	44—45
With even a year or two's watering many trees can be grown in Jodhpur such as <i>Acadrachta indica</i> (<i>neem</i>), <i>Albressia lebbek</i> (<i>siris</i>), <i>Acacia arabica</i> (<i>babul</i> or <i>kikar</i>), <i>Acacia catechu</i> (<i>khair</i>) and <i>Prosopis spicigera</i> (<i>khajri</i>). <i>Acacia arabica</i> and <i>Prosopis spicigera</i> adequately supply the needs of the villagers. <i>Prosopis juliflora</i> also supplies their needs and can regenerate itself in sandy soils down to a rainfall of 13 inches. It could probably grow down to a rainfall of 7 or 8 inches if it could once be started. It can be sown. Light ploughing or better still sowing in pits or trenches or with contour <i>bunds</i> is probably advisable for these dry areas. The seed may not germinate the first year but should do so later. A good deal of information on dry forest work can be found in Indian Forest Records, Vol. III, No. 8 and Vol. IV, No. 4.	... 46
Experiments should be started with <i>Prosopis juliflora</i> on ...	47
hilly areas.	

	Para
His Highness has already succeeded with <i>Prosopis juliflora</i> and <i>Cassia auriculata</i> on very bare stony soil at Sardar Samand.	... 48
Pastures should be properly managed and remote pastures would probably be suitably placed under the Forest department.	... 49
These proposals visualise a large expansion of the Forest department. Possibly controlling 1100 to 1400 square miles of <i>khalisa</i> area and perhaps many years hence 7,000 to 9,000 square miles of the whole State. The State has certain trained officers but I recommend that arrangements be made to train more.	... 50
Till men are trained, retired men might be employed.	... 51
The State needs fairly continuous advice from a much higher standard of officer but there is not sufficient scope to employ him continuously. A combination with certain other Rajputana States would enable such a forest adviser to be employed, though exactly how this combination is to be worked is not for me to say.	... 52
The forest surplus has risen from about Rs. 60,000/- in 1938-39 to about 2½ lakhs in 1942-43. I suggest part of this surplus should be kept for forest development after the war. The capital value of the Jodhpur State forest is too low but it can be built up by proper management without much outside expenditure.	... 53
Some expenditure may be necessary for afforestation of waste land placed under the Forest department. Possibly the remission of land revenue on land not cultivated at present may induce villagers to cultivate the land for two or three years, sowing forest crops with their <i>kharif</i> crop. Or villagers might be encouraged to afforest village waste if the trees produced remain their property but properly managed on their behalf by the Forest department.	... 54
Much improvement and increase in forest capital can be brought about merely by regulating grazing and with no direct cost except protection.	... 55

If experiments show that the worst hills can be afforested with ...

56

Prosopis juliflora, a decision can be made whether to extend the scheme of afforestation. On many of the hills near Sanderao protection alone will bring up a forest with no artificial regeneration or expenditure.

Although heavy expenditure on artificial afforestation is not recommended at present, it is recommended as soon as local skill becomes sufficient to regenerate areas with *Prosopis juliflora* with certainty. It will then be time to expand afforestation to the even dryer areas in the west.

57

Inspection Note on Jodhpur State.

The itinerary of my tour in Jodhpur was as follows-

January 19th—Arr. Jodhpur.

- „ 20th to
- „ 22nd—Round Jodhpur.
- „ 23rd—Jodhpur to Sheo area.
- „ 24th—Jodhpur to Sirohi State.
- „ 25th—Jodhpur via Pali to Jijawa.
- „ 26th—Halt at Jodhpur.
- „ 27th—Jodhpur to Balotra.
- „ 28th &
- „ 29th—Halt at Jodhpur.
- „ 30th—Left Jodhpur.

On January 24th I continued through Sirohi State to Mt. Abu but that particular portion is not dealt with in this report.

2. I thus saw a fairly complete cross section of the country from east to west and something to the north and south of Jodhpur. The tour is obviously too short to lay down a detailed plan for forestry in the State. It would be an advantage if a detailed examination were made and a more exact report on policy and organisation written taking an officer perhaps three to six months.

3. My thanks are due to His Highness the Maharaja of Jodhpur for permitting me to inspect the State to examine it from the forestry point of view. I must also thank Lt. Col. Sir Donald M. Field, C. I. E., Chief Minister of Jodhpur State, Mr. Edgar and Mr. Furgusson of the Public Works Department, Jodhpur State, and Mr. Bhai Charan Dass, the Superintendent of Forests, for the trouble they took over my tour. I must especially thank His Highness the Maharaja for personally taking me over areas of his State and pointing out to me what he had done. What he showed me will be referred to below. One of the recommendations which I shall make about the land management of Jodhpur State is the control of grazing and more especially the control of the goat. His Highness knows the necessity of that just as well as I do, because it was he who informed me of the necessity for doing this and he showed me his own experiments to prove it.

4. Only some 5,545 square miles out of the total of over 36,000 square miles of the Jodhpur State is *khalsa* land, that is to say, directly owned by the Jodhpur Government without any sub-tenure. The rest of the area is composed of *jagirs*.

Forest Policy and Management.

5. It appears that the State has no actual written forest policy. Without a written policy it is difficult to secure continuity.

6. The State has a forest act in the Marwar Forest Act of 1934 which is based on the Indian Forest Act (Act XVI) of 1927.

7. I am not clear whether there has been a complete forest settlement for the reserved forest area but, if further areas are taken up, rights and concessions must be definitely settled. The existing forests are demarcated and recorded on maps.

8. The 320 square miles of *Khalsa* area actually under the Forest department is situated in the east of the State towards the hills of Ajmer-Marwara and Udaipur. A proper working plan was made for 123 square miles of these forests constituting what was called the lower zone and consisting principally of *Anogeissus pendula* (*dhok*) with a good deal of *Acacia catechu* etc. The working plan is simple and manages the forest on the coppice system under a 40 year rotation. This working plan ends in 1946 and it is time it was revised so that a new working plan can be ready when the old plan ends. Though there are some technical inaccuracies in it, the working plan appears generally suitable and I propose to make no further comments on it. Its results will naturally be examined in detail by the officer revising the working plan. Generally, however, though the plan should be extended to cover the whole area of forest, I agree that the coppice with standards system is probably the best for these areas and that provided areas are closed after felling for five years, regeneration is likely to be adequate.

9. The right-holders do a good deal of unnecessary damage. Permits are issued to them to fell at any time and at any place. It is therefore impossible to supervise their fellings and impossible to prevent them felling standards. I suggest that the actual felling of rights timber might be limited to one or two months in the year when proper supervision would be possible. It would also be preferable if right holders were limited to some coupe before it were felled for sale so that after fellings the standards reserved for definite reasons of forest management would not later be felled by right holders.

10. At the time of making the working plan of 1906 there were apparently extensive *guzara* forests set aside to supply the ordinary village rights. I am informed that these *guzara* forests have now largely disappeared as a result of unregulated felling and grazing. Certainly the *guzara* forest areas which I saw were very bad being almost devoid of trees, over-grazed, with quite serious erosion and were a great contrast to the reserved forest nearby. I purposely give this example here because I shall later recommend larger areas to be put under the Forest department for this very reason namely that, though forest areas are put under other bodies for management with the best

of intentions, they invariably disappear in the course of time. These particular *gusara* forests seem to have been virtually ruined in the short space of 40 years.

Private ownership.

11. With such a large area of the State under *jagirdars* the question of private ownership of forests must necessarily arise. Whatever forest policy may be laid down for Jodhpur State, it is perfectly certain that one of the aims must be to recognise that certain areas must be preserved as forest, or even afforested, for the general well being of the country from the purely protective point of view, to minimise run-off and floods, to prevent erosion and the silting of streams and country, and to minimise the desiccating effect of the hot weather wind, thereby conserving whatever moisture falls. In a country like Jodhpur, whatever other functions forests may fulfil, this protective function is one of the most important.

12. But forests are more than a mere local possession and their use or misuse can affect the well being of the people well outside the boundaries of the area concerned. Thus, deforestation and excessive grazing of much of the hilly country along the south-east boundary of Jodhpur causes excessive floods in the tributaries of the Luni flowing through that area, followed by rapid drying up of the same streams. A more impressive example is that floods caused by the deforestation of the Himalayas affect the scouring of the Jumna and thereby the formation of the hideous Jumna ravines. The Jumna in turn influences the floods in the Ganges and people as far away as Bengal are influenced by the deforestation of the Himalayas hundreds of miles away from them.

But the correct management of land in the *khalsa* area of the Jodhpur State, important though it may be, must lose much of its significance if the forest land of the other 31,000 square miles of the State under private persons is, or may be, managed with no reference to this protective function.

13. The interests of private owners are almost necessarily comparatively short term interests whereas those of the State are essentially long term interests. Without giving all the pros and cons of State as compared with private ownership of forests, I may say that in every country in Europe some form of Government control over the devastation of private forests has been found necessary, proposals for this also figure in the post-war forest policy of Great Britain, and private forest ownership has virtually broken down in the United States of America. Several provinces in India have found that the powers given in Chapter V of the Indian Forest Act of 1927 are insufficient for adequate control and have drafted acts for the more direct control over private forests. Without knowing all the details of local conditions and the

terms of the various land tenures, it is not possible for me to say what degree of control should be exercised by the Central Jodhpur Government, but it does appear to me that some Private Forest Act is necessary which should legislate for such control depending on local conditions. This might vary from the prevention of mere destruction but with no provision for proper management (the minimum of interference with the private owners powers) up to the stage of the Jodhpur forest department taking over and managing the particular private forest on behalf of the owner, which is the ultimate stage of control without actually destroying private ownership.

14. So far as I was able to see, the privately owned land in the State was less well forested than the *khalsa* land, more especially on the hills which are important. There is plenty of forest devastation only too evident in the *khalsa* land also but it is even more evident in the private lands.

The Tract

15. A detailed description of the reserved forest can be found in the working plan. But as this reserved forest occupies far too small a proportion even of the *khalsa* land, a general review of the whole country from the forest point of view becomes necessary, though naturally in such a short tour I was unable to analyse conditions accurately and in detail. Generally speaking the Aravalli hills, running from the eastern border of the State near Ajmer-Merwara in a roughly south-western direction to Mt. Abu, are the main watershed and headwaters of the rivers of Jodhpur. There are other masses of hills rising as separate isolated massifs in various parts of the State which are also the headwaters of various streams, but generally speaking this main range of Aravalli hills on the border and even outside the border nearer Ajmer is the source and headwaters of the biggest river system of the State, the Luni river and its various tributaries. These hills are fairly well covered where they happen to be reserved forest, though even there the cover is not nearly as effective as it should be to prevent run-off owing to insufficient regulation of grazing. Elsewhere, however, the hills may be absolutely bare or so hacked and grazed that nothing is left except a few gnarled and scattered trees with other vegetation browsed down to small stunted bushes. Erosion is often obvious and often serious, the hills sometimes being already eroded down to bare rock.

16. On other hills the lack of soil may not be because of erosion but because no soil has ever existed. Even on those hills, however, trees are often struggling to establish themselves but the abuse to which they are subjected gives them very little chance.

17. The soil is generally fertile wherever it can get water. The trees in Jodhpur city itself, or in the south towards Sirohi, often have quite

good height growth and yet have only had one or two years actual watering to start them off. A great deal even of the desert soil also appears quite fertile if only it can obtain water, for example, the area in the neighbourhood of Melba about 25 miles from Jodhpur city on the way to Balotra where the river Jojri loses itself. The extra moisture has produced trees, a good 40 feet or more high, with *babul* increasing naturally. A few years closure would undoubtedly produce a very fine *babul* forest.

18. There are of course plenty of areas where the soil is difficult and unfertile even with water but that occurs in every province and State in India.

19. The rainfall is highest in the east along the main Aravalli hills and decreases as one proceeds westwards towards the great Indian desert. It is probably not more than about 20 to 25 inches on the Aravalli ridge but decreases rapidly. At Jodhpur city the average for over 50 years is just under 14 inches with of course individual years going down to 7 inches and at any rate one year, 1943, up to nearly 25 inches. Further west still the rainfall decreases to an average of probably about 8 inches.

20. This is a very low rainfall, but certainly down to 12 inches it is sufficient to support forest of the correct type, though there will be considerable difficulty in nursing the young trees over the months of May and June immediately following regeneration. It is equally certain that trees of a type can survive even below this rainfall, probably down to the minimum of 8 inches, though whether they can be regenerated in that rainfall without artificial watering is another matter.

21. During the months of May and June a dry hot dusty wind blows continuously. I am informed that the surface evaporation at Jodhpur is $7\frac{1}{2}$ feet per year which must be very nearly a world record and is over $2\frac{1}{2}$ ft. in the period April, May and June. But although this is obvious from the surface of a tank, it is equally certain that tremendous desiccation occurs from the surface soil in May and June, though that is not so obvious. Anything which could prevent this loss of the small rainfall which does fall, would help tremendously the general fertility of the country.

22. Moreover the amount of wind erosion is far more than is realised. It is very difficult to get any exact data, but there was some evidence to show that between Sheo and Jodhpur there are places where soil is disappearing at the rate of 25,000 tons per square mile each year, and this has been going on regularly for at least 50 to 100 years. There were places where there was some evidence to show that six crore of maunds of surface soil per sq. mile had disappeared. Again any method of land management which would prevent this would be of inestimable value to the State.

23. The following is an approximate general description of the tract which I saw. It covers a good deal of the State but does omit the portion

in the north which, however, I understand is not very different. Going from Jodhpur towards Ajmer one passes through flatish country with occasional irrigation tanks. On the whole the country is very dry with scattered trees of *Prosopis spicigera* (*khejri*). From Pali, for 10 miles along the Ajmer road (and how much further I do not know), every tree has been removed and though conditions vary, it is very much the same from that point to Marwar junction. Over large patches the country is reduced to almost desert conditions with very serious wind erosion. Almost everywhere, however, there are the remains of stunted trees browsed down to the ground but which would spring up immediately with protection. Going from Pali towards the Sirohi border, that is approximately south, the soil and country improve. As one approaches the hills there is obviously more rainfall. The trees are bigger and there is a large amount of *Cassia auriculata*, *Salvadora oleoides*, *Acacia leucophloea* and *Prosopis spicigera*. There are large areas of waste with all trees browsed down to the ground but again this would spring up and produce forest with a few years closure.

24. About 80 miles south of Jodhpur city, past Sandeno, occurs a mass of hills apparently entirely devoid of trees but actually with scattered *Anogeissus pendula* (*dhok*) again browsed down to creeping bushes. Here again closure would bring up this valuable tree.

25. Going west from Jodhpur city to Sheo just outside Jodhpur itself there are some bare rocky hills mostly under the care of the Forest department. There are scattered trees of *Acacia leucophloea* etc. and one or two *Anogeissus pendula*. These hills are interspersed with flat areas some of which are closed to grazing. The excellent response to such closure is very evident.

26. About 40 miles west of Jodhpur, the country is far more sandy and drier but scattered over everywhere are occasional fairly well grown specimens of *Prosopis spicigera*. There are miles of this waste land which at present can be producing nothing except a little very miserable grazing. There are occasional scattered very bare hills mostly of solid rock.

27. About 40 miles from Jodhpur city the first real sand dunes appear, but even there scattered *Prosopis spicigera* are fairly well grown. Some 50 miles out there are some completely bare stratified rocky hills. Rainfall here is probably down to about 10 inches. The country gradually gets drier as one proceeds westward from Jodhpur. By 100 miles trees have almost disappeared and only *Capparis aphylla* and *Zizyphus jujuba* remain, but even so the soil is often good, not even mere sand but rather sandy loam. I saw no areas of actual shifting sand. There are a number of sand dunes but all are covered in vegetation and apparently fixed, although the eastern end of the dune may still be just active. There is no doubt that strict grazing control would fix these dunes once and for all.

28. South of this particular east west line, towards Balotra, there is a large area with obviously rather more moisture and a large number of trees of *Prosopis spicigera*, *Acacia arabica*, *Anogeissus coronata*, etc.

29. The most interesting thing at Balotra is the spread of the plant *Prosopis juliflora* (Mesquite or Vilaiti khejra). Throughout all these journeys odd oases of this remarkable plant exist. It occurs in profusion all round Jodhpur city itself and there is indisputable evidence that it has regenerated itself naturally over considerable areas in this low rainfall of under 14 inches. At Pali the same thing has happened and there it is growing perfectly well on more or less *kallar* soil. But the most remarkable example is at Balotra. Some years ago, unfortunately I could find no record of the date, a certain number of seeds of *Prosopis juliflora* were sown along the river. I found the first selfsown tree at a distance of $3\frac{1}{2}$ miles from the original sowings. At a distance of $1\frac{1}{2}$ miles from the original sowings, the trees are now quite thick and in fact have formed a forest. Some of the trees are already 3 inches in diameter and 20 ft. high. This is all entirely naturally regenerated and has come up in a rainfall of about 12 inches on apparently pure sandy soil, and this despite grazing and even hacking because already the villagers are beginning to cut down the trees.

30. Here then is one solution to the very serious problem which faces large areas of India, that of afforesting sandy soil in areas of very low rainfall. This particular tree can be regenerated and grown in areas of apparently pure sand down to a rainfall as low as 12 inches without any assistance from artificial irrigation. There is a local legend that the trouble is to establish the first tree of *Prosopis juliflora* and that after that it regenerates easily from goat droppings or donkey droppings. The explanation of this is probably that passage through the animal makes germination easier.

Analysis of the land management

31. I was able to obtain certain figures for the *khalsa* area which are given below—

Total <i>khalsa</i> area	...	5,545	square miles.
Area under Forest department	...	320	" "
Area of cultivation	...	1,648	" "
Area of current fallow	...	2,922	" "
Area of culturable waste	...	132	" "
Area of unculturable waste	...	523	" "

I was unfortunately not able to obtain a really accurate figure for the cattle population. Accurate figures were given for the cattle population

of the whole State, but for my purpose I needed the cattle population of the *khalsa* area only. Although I obtained a figure it was probably too low. However, for what it is worth, I give it. Including all cows and buffaloes it is about 3,20,000. This excludes nearly 7 lakhs of sheep and over 3½ lakhs of goats in the same area besides horses, mules and camels.

32. It will be noticed that the forest area represents only some 6 percent of the total *khalsa* area. It ought to be nearer 20 or 25 %. Moreover, I was able to obtain a figure for the forest area for the whole State and it came to only 450 square miles out of 36,000 square miles, that is to say, only just over 1 per cent. This bears out what was stated in paragraph 14 that forest devastation is far worse in the *jagirs* than in the *khalsa* area.

33. These figures are worth studying. Apart from the lack of protective effect, with only some 6 per cent of the *khalsa* area covered with effective forest (and the infinitesimal percentage of 1% for the whole State), the supply of ordinary fuel and small timber throughout most of the country must be deficient, more especially when it is realised that even the 6 per cent of the forest of the *khalsa* area is practically all situated on a narrow strip of country 80 miles or so from Jodhpur city. Over most of the State, where almost everything has been removed, the villagers must be burning cowdung as fuel. Although it is impossible to give exact figures, it may be guessed that the cows and buffaloes in the *khalsa* area alone produce about 5½ lakhs of tons of manure per year. If the figure of cattle population given me was really too low, as I suspect it was, then the real weight of manure is proportionately more. This 5½ lakhs of tons is capable of adequately manuring about 230 square miles or say 1½ per cent of the whole of the cultivation in the *khalsa* area. How much of this cowdung is actually burnt, and how much does in fact find its way on to the soil for manure, it is impossible to say but I think nobody will consider it an exaggeration to say that half the total is in fact burnt, that is to say, sufficient adequately to manure 7 per cent of all the cultivation in the *khalsa* area. Whether these figures are correct or not, they are sufficiently correct to show the importance of using this cheap source of natural manure for its legitimate purpose of improving food production rather than burning it as fuel. The statement sometimes made that the villagers must burn cowdung because of its suitability for certain domestic purposes is not correct. Wherever proper wood fuel can be easily obtained, villagers burn it as fuel and though they may still burn a very little cowdung for certain special purposes, it is no longer the source of ordinary fuel. Moreover, even for those special slow burning processes for which cowdung is so efficient, a

perfectly good substitute can be made by converting the wood into charcoal dust and then making briquettes from it.

34. It will be seen that there are 2,922 square miles of current fallow, 132 square miles of so-called culturable waste and 523 square miles of so-called unculturable waste. Probably the large area of current fallow really represents grazing area, and it is certain that most of it is grazed. Assuming that the ideal forest area of the *khalsa* area is between 1100 and 1400 square miles, it means finding between about 800 square miles and 1100 square miles more. There is not the slightest doubt that out of this enormous area of over 3,500 square miles of current fallow, culturable waste and unculturable waste, it would be comparatively easy to find an adequate area for forest so distributed that it would supply the villagers' needs for small timber and fuel.

35. Pastures, and grazing generally, are also of interest to forest officers. What the production of fodder is from the very over-grazed areas in the State I am unable to say. But from enquiries and from my own experience in other places, I doubt if it is more than about 3 to 4 maunds of dry hay per acre per annum. While the improvement of pastures is a specialised form of land management, there is no doubt whatever that some perfectly simple form of grazing regulation throughout the State would vastly improve fodder production. Simple closure in rotation, properly regulated, would undoubtedly at least treble the fodder production in Jodhpur State.

36. There seems little doubt that if an adequate area of State were under forest, which itself would improve the grazing, and a large proportion of this forest were managed to supply the local needs of the agricultural villager with small timber and fuel, thereby saving his cowdung for manure, and at the same time the grazing over the State in general were regulated, the whole prosperity of the State and the people would improve vastly. Both food and fodder production would increase considerably and fodder famine would be a thing of the past. Moreover, if, as will be proposed, a large amount of the afforestation is done with *Prosopis juliflora*, that tree produces excellent fodder from its pods, quite sufficient to remove the fear of fodder famine for ever. In addition, the improved forest estate would eventually bring considerably increased revenue to the State. Apart from this, the general fertility of the country would be greatly improved. I do not suggest that the actual amount of rain falling in Jodhpur would be increased, though that may very well happen, but the 12 or 13 inches of rainfall which falls now disappears rapidly in evaporation and floods which carry with them the valuable top soil. This rainfall would be absorbed into the soil and retained there for considerable periods, so that the general

moisture content of the soil layers would be far higher than at present. The trees would also act as a shelter belt to lessen the force of the desiccating hot weather wind and would to a large extent mitigate the dust storms which are carrying away the huge quantity of soil mentioned in para. 22.

Recommendations.

37. It is difficult after so short a tour to make detailed suggestions of how generally to improve the forest position. The main objects of a forest policy and management for Jodhpur State appear to be:—

- (a) Protective. To prevent run-off, floods and denudation and to minimise the effects of the desiccating hot winds and to prevent wind erosion.
- (b) In addition to the ordinary production of timber forests for State revenue, to produce small timber and fuel for the ordinary agriculturist to save cowdung for manure.
- (c) To care for the general well being of the cattle.
- (d) General amenities like the improvement of *shikar*, beautifying the land etc.

At present none of these objects are being adequately fulfilled. Not even the last, for *shikar* must have deteriorated sadly almost all over the State.

38. I suggest that the Jodhpur State should write a forest policy, and, among other things, should lay down that the ultimate aim is for 20 to 25 per cent of the whole State to be under forest management. This forest should be so distributed that the ordinary villager can obtain his fuel and timber more or less on his door step.

39. Some control over private forest will be necessary. I suggest that a proper Private Forest Act to legalise such control should be drafted. The act should legislate for various degrees of control depending on local conditions but where necessary should permit the Jodhpur Government to take over complete management on behalf of the owner under certain terms.

40. The land should then be classified and definite areas set aside for the growing of trees. In classifying the land dedicated for tree growth, that necessary for the protection of the headwaters of streams and to prevent run off, floods and erosion etc., should be specifically designated and for such land this object of management should over-ride all others.

41. It must be a matter of local administration to decide what agency should manage the forest land. That which must be managed for its protective function would mostly be under the Forest department. I suggest that all hilly areas throughout the State should be placed under the Forest department pending further classification and allotment.

42. The large area which will occur outside the hills, which may possibly amount to between 800 and 1100 square miles in the *khalsā* area (and eventually 7,000 to 9,000 square miles in the whole State), which should be dedicated to forestry, may, or may not, be directly under the Forest department. Much of it will be village waste and it may not be possible to manage it except through village communities. Even so, however, I suggest that it should be the business of the Forest department to help start such areas. They should be managed under short rotations of 15 to 20 years under proper working plans with the object of producing the small timber and fuel required by the villager. Nor is this merely a long term policy. The first returns from this land should be obtained from thinnings within five years of afforestation.

43. Over much of the area actual afforestation will be unnecessary. Though excessive grazing has reduced large areas of potential forest land in the Jodhpur State to mere stunted bushes browsed down to the ground, the tree growth is not actually killed. Over all that large area protection and regulation of grazing would again produce a forest in a very few years.

44. Nobody knows this better than His Highness himself. He showed me personally an area just outside Jodhpur town where he had closed a piece of desert nine years ago. The area closed had been exactly like the surrounding country with sandy soil on which were a few *Prosopis spicigera* and a few stunted *Zizyphus jujuba*, *Capparis aphylla* etc. The area now is completely different. There is plenty of grass, *Zizyphus jujuba* and *Capparis aphylla* are up to 9 ft. high and there are plants every few yards with occasional really dense patches. There are many new young *Prosopis spicigera* trees 3 ft. high. Nothing was done whatever except to close the area, it was not even ploughed. This surprising change shows what can be done and if 9 years ago when it was closed it had been artificially regenerated with *Prosopis juliflora* even in a few patches, the result to-day would have been a solid forest.

45. His Highness showed me another area approaching Sardar Samand consisting of grass, a few stunted *Capparis aphylla*, *Zizyphus jujuba* and *Prosopis spicigera* which was only closed last year. Already the closed area looks completely different from the surrounding country. *Capparis aphylla* and *Zizyphus jujuba* are already 4 to 5 feet high and the whole vegetation has thickened considerably.

46. The species to grow in any place must be regulated according to the object of management and according to the individual area concerned. What is necessary is to find species which will grow without irrigation in waste lands very often of very sandy soil such as occur all round Jodhpur city and even more as one proceeds towards the western boundary. While watering is possible for roadside trees or in parks and pleasure gardens, it is

far too expensive in ordinary forest operations even for a year or two, unless proper irrigation happens to be already available in the area. Given a start with even a year or two's watering, there are plenty of species which can grow in the soil and climate of Jodhpur such as *Azadirachta indica* (*neem*), *Albizzia lebbek* (*siris*), *Acacia catechu* (*khair*), *Acacia arabica* (*babul* or *kikar*), *Prosopis spicigera* (*khejri*) and in fact almost any of the trees found in the rather drier parts of the Gangetic plain. But to grow species without water of any sort in these areas needs more careful selection. The trees for these areas to supply the ordinary wants of the villagers should be those which are quick growing, drought resistant, provide some sort of fodder, give suitable small timber for agricultural wants, provide good fuel and make good charcoal. Obvious species are *Acacia arabica* (*babul*) and *Prosopis spicigera* (*khejri*). Both these trees already grow extensively in many parts of the State and it is a good rule in forestry to grow what is growing already. But both these species may be difficult when it comes to afforesting an area which has been allowed to become devoid of trees. Jodhpur, however, has already made a start with the most suitable tree for all such areas, namely *Prosopis juliflora*. Once started this tree regenerates itself in sandy soils, in areas with a rainfall down to 13 inches for certain and, if it can only be once started, possibly down to 7 or 8 inches. Experiments are still needed on the best way of transplanting the species but it certainly can be sown. There is some difficulty about its germination but it is known to germinate well when passed through a goat or donkey and it might pay to collect as much seed as possible from goat pens. For the time being I recommend that the seed be put in boiling water and, after the water cools, left in it for 48 hours. It should then be sown towards the end of May and a second sowing made immediately the first rains break. It is probably sufficient merely to scratch the surface of the soil so that the seed is covered, but a light ploughing would be better if it is not too expensive. It would be better still in these dry areas to sow at the bottom of a pit or trench or with a contour *bund*. If the seed does not germinate the first year, it should be sown again the next year, but eventually in a year of the correct rainfall it will germinate. When it has germinated and got anything of the start, though it may die out in the hot weather, it will spring up again and it grows very quickly. The moment a patch is properly started it will regenerate itself all round, as is amply proved on many waste areas in different parts of the State, and with a rainfall down to as low as 12 or 13 inches. It is very soon big enough to escape goat grazing and a couple of years protection should suffice. As the Jodhpur State knows, its pods provide excellent fodder and if the tree is at all widely grown, it should eliminate any question of a fodder famine in Jodhpur. With the requisite technical skill there is no doubt this tree will succeed over very large areas of the State as in fact it has already succeeded. With it can be sown both *babul* and *khejri* and *Prosopis juliflora* will to a certain extent protect and help these trees. Records at Dehra Dun show that germination is

easy in 20"-25" rainfall . Much information can be found in Indian Forest Records Vol. III No. 8 and Vol. IV No. 4.

47. Connected with this is the management of those hilly areas so denuded that even the strictest protection is unlikely to bring in trees. I do not advocate extensive schemes of afforestation of such hills at present, but I do advocate a certain number of experimental areas on which *Prosopis juliflora* should be sown. If success is attained, and I have no doubt that it will be attained, then such areas can be extended into demonstration areas throughout the State.

48. His Highness showed me another of his experiments which proves how astonishingly this remarkable tree can grow on almost bare rock. Just outside Sardar Samand is a bare stony hillside, steep on one side down to the lake and extending almost to the plains on the other side. On this bare stony soil were originally a few scattered *Prosopis spicigera* and *Zizyphus jujuba* and possibly one or two *Acacia rupestris* like so much of the country around. In 1937 and 1938 *Cassia auriculata* and *Prosopis juliflora* were sown in trenches over the area. Nothing appeared in 1938, 1939 and 1940. There was goodish rain in 1941-42 and very good rain in 1943. In 1942 His Highness saw that some plants were coming up and he fenced the area. It is now very good indeed and will obviously be full of trees in a very short time. A few of the *Prosopis juliflora* were planted and not sown.

49. I suggest that pastures should be put under some form of management. Whether these should be under the Forest department or some other department must be for the local authorities to decide. But I suggest that for the extensive and often rather remote areas which have to be dealt with, the Forest department may be the most suitable department to chose.

50. All this visualises an eventual large expansion of the Forest department and forest work, possibly controlling 1100 to 1400 square miles of *khalasar* area alone as reserved forest, village forest and pasture lands. If this is extended throughout the State, a total area eventually of from 7,000 to 9,000 square miles may become forest. Naturally that final result may only be attained many years hence, but the immediate proposals of properly managing all the hilly areas only, plus propaganda, advice and control of village forests with direct afforestation of some areas of waste land, means an expanding department of trained men. The State has a trained forest officer in Mr. Bhai Charan Dass and three other Rangers have been trained at the Foresters School at Balaghat. For immediate needs at least three or four trained Rangers are needed and several foresters. I suggest that steps be taken to train Rangers as soon as possible at Dehra Dun and that meanwhile one or two seats a year be applied for at the various Foresters Schools throughout India. That most suitable for the Jodhpur State is the

Central Provinces school at Balaghat. But other such training schools exist in the Punjab, the Eastern States Agency, the United Provinces and Bengal though some are in abeyance because of the war.

51. Meanwhile, to tide over the period till the State has its own men trained as Rangers, I advise advertising in the newspapers of the various provinces for retired men.

52. But I suggest that Jodhpur State needs the regular services of an officer of at least the experience and technical skill of the best conservators of forests in the ordinary province of British India. The salary that would be necessary to bring such a man to the State would be far more than is consistent with the area within the State which he would have to control in the near future, nor at present is there any necessity for that particular standard of advice for the whole year. I do recommend, however, that an arrangement be made by which several of these Rajputana States combine, so that while each of them has the benefit of the higher standard of advice and control, the cost divided among the several States would be commensurate with the work the officer would have to do in each individual State. Whether this arrangement should be made by an actual combination or whether one State should employ the officer with an arrangement for lending him to other States, is a matter of detail with which this report need not deal.

Finance

53. How the State should finance any schemes which it takes up is perhaps hardly my affair. But may I say that I am not suggesting that the Jodhpur State should spend vast sums either on reclaiming devastated hill sides or on large afforestation schemes either of the headwaters of streams or of the waste lands in the plains or on the enormous dry semi-desert area to the west. The forest revenue was $1\frac{1}{2}$ lakhs in 1938-39 and has risen steadily till it was $3\frac{1}{2}$ lakhs in 1942-43. The expenditure has also risen from about Rs. 90,000/- in 1938-39 to just over a lakh in 1942-43, and this expenditure includes what is called arboriculture expenditure. This means that the surplus has risen from about Rs. 60,000/- in 1938-39 to about $2\frac{1}{2}$ lakhs in 1942-43. It might be advisable to create a sort of sinking fund for part of the large increase caused by the rise in prices owing to the war for forest development after the war, and, at the same time, further to finance the department by putting back part of any further increases in surplus. There is no doubt that the capital value of the forests of Jodhpur is very much below what is necessary for the well being of such a State and in some way or other this forest capital should be built up.

But much of it can be built up by proper management of the forest or the potential forest areas themselves without much outside expenditure.

54. For the afforestation of the waste land placed under the Forest department, some expenditure may have to be incurred. There must be waste areas from which the State at present derives no revenue but which cultivators might be prepared to cultivate provided they were allowed to do so without paying land revenue. It might be well worth while allowing this on condition that during the two or three years tenure permitted, forest plants were sown in lines at specified distances with the *kharif* crop. In this way the State would lose nothing and would get the land afforested at a very low rate or even free. In the same way, on actual village waste land, methods might be evolved to induce the villagers to plant and care for the trees. One obvious way is to let all such approved planting of trees become the common property of the village to be managed under proper working plans controlled by the Forest department but for the entire benefit of the villager. This is a normal method for the communal forest on the continent of Europe and works excellently, the villagers becoming the most zealous guardians of their own property. At the same time the State also benefits by the general increased productiveness and prosperity of the country.

55. A very large amount of improvement and increase in forest capital can be brought about by regulating the grazing alone at no direct cost except the cost of protection.

56. If experiments show that the worst denuded hills can in fact be afforested with *Prosopis juliflora*, as in fact His Highness's experiment at Sardar Samand has already shown, then a decision can be made whether an extensive scheme of afforestation of such hills is worth while or not. So far as I saw, the hills belonging to the main Aravalli ridges and the mass extending out all round the neighbourhood of Sanderao would largely reclothe themselves with trees if placed under the Forest department and given adequate protection with no artificial regeneration or expenditure.

57. But though I would not recommend immediate heavy expenditure on artificial afforestation of large areas of waste lands in the State, I have no doubt whatever that such afforestation would pay the State handsomely as soon as sufficient experience has been gained for it to become a routine matter. The amount of successful artificial regeneration with *Prosopis juliflora* already in the State shows that over large areas it could very easily be reduced to routine. At that stage afforestation over large areas would be advisable. At the same time the skill gained can be used to experiment in the even drier and sandier areas further to the west.